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A MONOGRAPH
OF THE
GYMNOBLASTIC OR TUBULARIAN
HYDROIDS.

BY
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DUBLIN AND OXON.,

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OF EDINBURGH.

CONCLUSION OF PART I,
AND
PART II, CONTAINING DESCRIPTIONS OF THE GENERA AND
SPECIES OF THE GYMNOBLASTEA.

Edin.

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PLATE 1.

CLAVA SQUAMATA.

FIG.

1. A male colony magnified. The hydranths are seen, some fully extended, others in various states of contraction.
2. The same, natural size, attached to a piece of *Fucus nodosus*.
3. A cluster of female gonophores.
4. A portion of the hydranth-walls, after having undergone natural histolytic decomposition, very much magnified. The ectoderm is seen to the left, resolved into minute cell-like elements, limited externally by a delicate structureless pellicle, and separated from the endoderm by a layer of fibrillated (muscular) tissue. The endoderm is breaking up into large spherical cells.
5. A male gonophore. The spadix is surrounded by the spermiatic mass.
6. A female gonophore. A single ovum, with its germinal vesicle and germinal spot, lies on one side of the spadix, which it has pushed out of the axis of the gonophore.
- 7—11. Development of the embryo.
7. The embryo still confined within the walls of the gonophore, from which it is ready to escape into the surrounding water.
8. Embryos liberated as ciliated planulae from the gonophores. They are drawn in various positions which they are in the habit of assuming, and may be seen either fully extended or more or less bent upon themselves.
9. The planula, after it has lost its cilia and has become contracted longitudinally preparatory to fixing itself.
10. The planula after it has become fixed and has developed a single verticil of tentacles.
11. The young *Clava* still further developed. A second verticil of tentacles has been emitted at the proximal side of that first formed, the tentacles of the second verticil alternating with those of the first; a stolon has begun to be emitted from the base.



Clara squamata



PLATE II.

CLAVA MULTICORNIS, CLAVA DIFFUSA, TUBICLAVA FRUTICOSA, TUBICLAVA LUCERNA.

FIG.

1. *Clava multicornis*, magnified.
2. The same, natural size.
3. *Clava diffusa*, magnified.
4. The same, natural size.
5. *Tubiclava fruticosa*, magnified.
6. The same, natural size.
7. *Tubiclava lucerna*, magnified.
8. The same, natural size.





PLATE III.

CORDYLOPHORA LACUSTRIS.

FIG.

1. Portion of a female colony, magnified; *a*, very young gonophore; *b*, gonophore more advanced, containing ova, which are embraced by the branches of a ramified spadix, and have their germinal vesicles distinct; *c*, gonophore still further advanced; the ramifications of the spadix have disappeared, and the segmentation of the vitellus has been completed in the ova; *d*, further stage of development, in which the ova have become planulæ, and are ready to escape from the gonophore; *e*, the gonophore has become ruptured at the summit, and the ciliated planulæ are escaping into the surrounding water.
2. A colony of *Cordylophora lacustris*, of the natural size, attached to the under surface of a piece of floating timber.
3. A male gonophore, the spermiatic mass embraced by the ramifications of the spadix.
4. The distal portion of a male gonophore still more magnified: *a*, external chitinous investment, showing layers of deposition; *b*, ectotheca; *c*, endotheca; *d*, ramified spadix embracing the spermiatic mass.
5. Planula much magnified, in two different states of contraction. Its interior is occupied by a large cavity, and an ectoderm and endoderm are distinctly visible in its walls.
6. The planula after it has lost its cilia and has become fixed.
7. Further stage of development, in which the distinction between stem and hydranth has become apparent, and a verticil of four tentacles has begun to be developed from the hydranth, while the stem has excreted a delicate chitinous perisarc.
8. The young *Cordylophora* still further developed; the tentacles are still in a single verticil, but have increased in length, and the hypostome has become prominent.
9. Mature spermatozoa; in the group to the left the heads are still enclosed in the generating cell.



Cardulophora lacustris



PLATE IV.

CORYNE PUSILLA, CORYNE VAGINATA.

FIG.

1. Portion of a female colony of *Coryne pusilla*, magnified.
2. A colony of *Coryne pusilla*, natural size, attached to a piece of *Fucus serratus*.
3. A tentacle of *Coryne pusilla*, very much magnified, showing its chambered endoderm and its capitulum loaded with thread-cells.
4. A thread-cell from the capitulum before the emission of its contents, and with the superficial portion of the ectoderm in which it is imbedded carrying a palpocil.
5. A thread-cell from the capitulum after the emission of its contents.
6. Mature ovum of *Coryne pusilla*, as it appears just after liberation by the natural rupture of the gonophore. In this stage the germinal vesicle becomes visible under compression.
7. Planula of *Coryne pusilla*; the cilia are very long. A peculiar striated area is visible towards one end.
8. A portion of a female colony of *Coryne vaginata*. At the left a hydranth-bud is seen, entirely enveloped in a delicate sac-like extension of the perisarc.
9. A colony of *Coryne vaginata*, natural size, attached to a piece of *Cystoseira*.



7. *Ceratium pusilla* 8. 9. *Ceratium vasculata*



PLATE V.

SYNCORYNE EXIMIA.

FIG.

1. A portion of a colony magnified, the hydranth to the left, loaded with planoblasts.
2. A colony, natural size.
3. A planoblast shortly after liberation, very much magnified ; and, as it appears, with its tentacles extended when floating passively in the water.
4. Terminal portion of a marginal tentacle of the planoblast, showing its continuous axial tube, and its ectodermal spherules loaded with thread-cells.



Uncaria eximia



PLATE VI.

SYNCORYNE PULCHELLA, SYNCORYNE FRUTESCENS.

FIG.

1. *Syncoryne pulchella*, magnified.
2. The same, natural size.
3. A planoblast of *Syncoryne pulchella*, shortly after liberation, as it appears while floating passively in the water.
4. *Syncoryne frutescens*, magnified.
5. The same, natural size.
6. Planoblast of *Syncoryne frutescens*, shortly after liberation.



1. Succeryne pulchella (Pl. 11)

Succeryne frutescens (Pl. 11)

1-5. *Succeryne pulchella* 4-6. *Succeryne frutescens*



PLATE VII.

GEMELLARIA IMPLEXA.

FIG.

1. A portion of a colony, magnified.
2. A colony, natural size, attached to a piece of rock.
3. A planoblast shortly after liberation, as it appears while floating passively in the water, very much magnified. The tentacular appendages are seen with their peduncles in various states of extension.
4. A marginal tentacle of the planoblast still more enlarged, and with the appendages entirely retracted.
5. Longitudinal section of a portion of the hydranth showing histological structure: *a*, ectoderm with imbedded thread-cells; *b*, muscular layer; *c*, external large-celled layer of endoderm; *d*, internal or glandular layer of endoderm immediately surrounding the somatic cavity.
6. One of the clavate sacs filled with thread-cells from the umbrella-margin of the planoblast.
7. A thread-cell from the capitulum of a tentacle previous to evolution.
8. The same after evolution.
9. One of the large thread-cells from the ectoderm of the hydranth previous to evolution.
10. The same after evolution.



Gemellaria implexa



PLATE VIII.

DICORYNE CONFERTA.

FIG.

1. Portion of a colony enlarged. The sporosacs are borne upon blastostyles, which spring, some from the hydrocaulas, and some from the hydrorhiza.
2. A colony of the natural size, spreading over a shell of *Buccinum undatum*.
3. The female locomotive ciliated sporosac, shortly after liberation from its ectotheca, as it appears when swimming. It is viewed at right angles to the plane of its two tentacles.
4. The same viewed in the plane of the tentacles.
5. The male sporosac still enclosed within its ectotheca.
6. The same after liberation from the ectotheca, as it appears when swimming.
7. Longitudinal section of a female sporosac made at right angles to the plane of the tentacles, and viewed under slight compression.

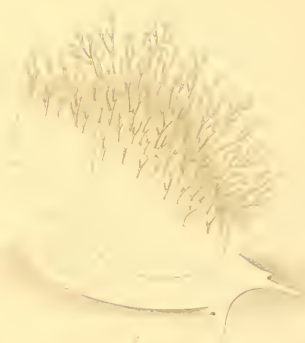




PLATE IX.

BOUGAINVILLIA FRUTICOSA, BOUGAINVILLIA RAMOSA, BOUGAINVILLIA BRITANNICA.

FIG.

1. *Bougainvillia fruticosa*, magnified.
2. The same, natural size, attached to the under surface of a piece of floating timber.
3. A planoblast of the same, just after liberation, and in the act of swimming away from its trophosome.
4. The planoblast floating passively in the water.
5. *Bougainvillia ramosa*, magnified.
6. A colony of *Bougainvillia ramosa*, natural size.
7. A planoblast of *Bougainvillia ramosa*, shortly after liberation, as it appears while floating passively in the water.
8. Mature planoblast (*Bougainvillia Britannica*), drawn from a specimen captured in the open sea. This planoblast has not yet been referred with sufficient certainty to its trophosome.



100. 101. 102. 103. 104.

105. 106. 107. 108. 109.

1. *Bomarea frutesca* 2. *Bomarea ramosa* 3. *Bomarea Brittanica* 4. *Bomarea*



PLATE X.

BOUGAINVILLIA MUSCUS, HETEROCORDYLE CONYBEAREI.

FIG. *

1. *Bougainvillia muscus*, magnified.
2. The same, natural size.
3. Planoblast of the same, shortly after liberation.
4. *Heterocordyle Conybearei*, magnified: *a*, hydranth, in which the tentacles have assumed a clavate form as the result of contraction; *b*, young hydranth; *c*, blastostyle extended with its sporosacs; *d*, the same contracted.
5. A colony of *Heterocordyle Conybearei*, natural size, spreading over a *Buccinum* shell.
6. Female sporosac of same.
7. Male sporosac of same.



1-5 *Bougainvillia muscus* 6-7 *Heterocordyle Cuybearet*



PLATE XI.

PERIGONIMUS VESTITUS, PERIGONIMUS MINUTUS, PERIGONIMUS SERPENS.

FIG.

1. *Perigonimus vestitus*, magnified.
2. The same, natural size, extending over the surface of a *Buccinum* shell.
3. Planoblast of same, shortly after liberation, and in the act of swimming.
4. *Perigonimus minutus*, magnified.
5. The same, natural size, attached to the operculum of *Turritella communis*.
6. Planoblast of same, shortly after liberation.
7. *Perigonimus serpens*, magnified.
8. The same, natural size, on a fragment of *Plumularia*.
9. Planoblast of the same, shortly after liberation, and seen while swimming.



125. *Perigynium vestitus* 126. *Perigynium minutus* 127. *Perigynium* (L.)



PLATE XII.

BIMERIA VESTITA, GARVEIA NUTANS.

FIG.

1. *Bimeria vestita*, magnified.
2. The same, natural size.
3. An ultimate ramulus of same, carrying a male sporosac, much enlarged, to show the structure of the sporosac with its ramified spadix.
4. *Garveia nutans*, magnified.
5. The same, natural size.
6. Distal portion of tentacle of same, much magnified.
7. A female sporosac of same, much magnified: *a*, ectotheca invested by a delicate chitinous pellicle; *b*, mesotheca; *c*, endotheca; *d*, rudimental radiating canals in the proximal portion of the mesotheca.
8. A male sporosac of same.
9. Spermatozoa of same. The mode in which the head of the spermatozoon is occasionally curved upon itself is here seen.
10. Planula of same.
11. Young of same, developed from the planula.



15. *Bimelia barthelemyana* (L.H. barthelemyana)

Herbar. J. P. de

Herbar. J. P. de



PLATE XIII.

EUDENDRIUM RAMOSUM.

FIGS.

1. A portion of a male colony cut from the end of a primary branch, magnified. Some of the hydranths are seen to be loaded with bithalamic gonophores, while they still retain their tentacles; in others, the tentacles have disappeared, and the hydranth has become converted into a pseudo-blastostyle.
2. A colony of the natural size attached to the back of an oyster-shell.
3. A hydranth, with part of its supporting ramulus, from a female colony. The gonophores are seen springing, some from the body of the hydranth, and some from the distal part of the ramulus. In some of the younger gonophores the spadix is seen bending round the ovum, so as to embrace it in its curvature; in the more mature ones the ovum has undergone segmentation and fills the cavity of the sporosac.
4. Male sporosac more magnified than in fig. 1.
- 5—16. Development of the embryo.
5. Very young female sporosac containing a single ovum, in which the germinal vesicle and germinal spot are still visible; the spadix is seen to be pushed to one side by the ovum, and to be gradually curving round it.
6. Same more advanced; the spadix has now almost entirely surrounded the ovum.
7. A still older sporosac, in which the fecundated ovum has attained an advanced stage of segmentation.
8. Isolated segment-spheres more magnified.
9. Germinal vesicle from an earlier stage of the ovum, isolated, and showing the germinal spot and its contained punctum.
10. The ciliated planula.
11. The planula after it has lost its cilia, previously to becoming fixed.
12. The planula become fixed by a disc-like enlargement of one extremity.
13. Embryo more advanced; the disc of fixation more decidedly differentiated, while a delicate chitinous perisarc has become excreted over the whole surface of the embryo.
14. The disc has begun to be divided into radiating lobes, and the hypostome has become differentiated.
15. The hydranth is now distinctly differentiated from the hydrocaulus, while the tentacles have begun to sprout round the hypostome, and within a delicate chitinous sac, which envelops the whole.
16. The hydranth has attained to nearly its ultimate form, and has burst through the chitinous sac, which had hitherto confined it, and the tentacles are now free to extend themselves in the surrounding water.
17. Spermatozoa. A minute corpuscle, like a parietal nucleus, is seen adherent to the head of each.





PLATE XIV

EUDENDRIUM CAPILLARE, EUDENDRIUM INSIGNE,¹ EUDENDRIUM VAGINATUM.

FIGS.

1. *Eudendrium capillare*, male colony, magnified. The sporosacs are bitbalamic, and the hydranths which carry them are all atrophied and converted into pseudo-blastostyles.
2. A colony of *Eudendrium capillare*, natural size.
3. An atrophied hydranth of *Eudendrium capillare*, carrying female sporosacs. The spadix curving round the ovum.
4. A portion of a male colony of *Eudendrium insigne*. One of the hydranths loaded with sporosacs.
5. A colony of *Eudendrium insigne*, natural size.
6. Summit of a hydranth-bearing ramulus, from a female colony of *Eudendrium insigne*, carrying sporosacs. The spadix curving round the young ovum.
7. *Eudendrium vaginatum*, portion of a colony, magnified. A young hydranth-bud, as yet destitute of tentacles, is seen to be enclosed in a delicate chitinous capsule, while a sheath-like extension of the perisarc invests the body of the mature hydranths.
8. *Eudendrium vaginatum*; a colony, natural size.

¹ Named "humile" in the plate. For the reasons of change of name, see the description of the species, page 337.



Colours in Nat. size

Illustrations by J. Smith

1-5. *Eudendrium capillare* 6-8 *Eudendrium humile* 9-11 *Eudendrium vaginatum*



PLATE XV.

HYDRACTINIA ECHINATA.

FIGS.

1. Portion taken from near the margin of a female colony, magnified; *a, a, a*, hydranths in various states of contraction; *b, b, b*, blastostyles laden with sporosacs; *c, c, c*, spiral zooids.
2. A colony, natural size, spreading over the surface of a buccinum shell inhabited by a hermit crab.
3. A blastostyle from a male colony, more magnified than fig. 1, laden with sporosacs.
4. Transverse section of one of the chitinous spines from near the base; *a*, ectoderm investing the surface of the spine; *b*, endoderm occupying its furrows and channels; *b'*, one of the tubular cavities of the endoderm with its coloured lining; *c*, one of the longitudinal chitinous ridges of the spine.
5. Transverse section of one of the chitinous spines from near the summit.
6. A female sporosac seen in longitudinal section.
7. Longitudinal section of one of the chitinous spines; *a*, superficial covering of ectoderm; *b, b*, endoderm with its included cavity occupying the superficial furrows of the spine; *c, c*, the chitinous walls of the spine showing successive layers of deposition; *d, d*, longitudinal chitinous ridges; *e, e*, proximal portions of two hydranths developed from the superficial cœnosarcal investment of the spine.



Hydrotima ciliata

Hydrotima ciliata

Wiederscheider, Bot.



PLATE XVI.

PODOCORYNE CARNEA, HYDRACTINIA ECHINATA.

FIG.

1. Portion of a colony of *Podocoryne carnea*, magnified; *a, a, a*, sterile hydranths in various states of contraction; *b, b*, proliferous hydranths laden with planoblasts, the planoblasts in various stages of development.
2. A colony of *Podocoryne carnea*, natural size, spreading over the surface of a piece of submerged rock.
3. A planoblast just after its liberation from the trophosome floating in the water, and with its tentacles extended.
4. The same with its tentacles contracted and thrown up round the margin of the umbrella.
5. Planoblasts in the act of swimming seen at the moment of systole, the umbrella strongly contracted and assuming a conical form.
6. A free planoblast more magnified, floating in the water, and with its tentacles extended.
7. One of the oral lobes of the manubrium of the planoblast showing its pencil of stalked thread-cells.
8. Portion of the umbrella-margin of a planoblast; *a*, marginal tentacle; *b*, a radiating canal; *c*, circular canal; *d*, ectoderm of margin, where it forms a cushion-like thickening on the bulbous root of the tentacle; *e*, ectoderm continued round the extreme margin of the umbrella.
9. A portion of the common basis of a young colony, showing its coalescent chitinous tubes.
10. *Hydractinia echinata*, vertical section through the common basal expansion extending from the free towards the attached surface; some of the coalescent chitinous tubes filled with cœnosarc, others empty; *a, a*, superficial layer of ectoderm extending over the free surface; *b*, cœnosarc tube lying in one of the superficial chitinous channels; *c, c*, walls of the adnate chitinous tubes; *b*, proximal extremity of a hydranth, its cavity continuous with that of one of the cœnosarc tubes of the common basis.
11. Portion taken from the edge of the basal expansion in a colony of *Hydractinia echinata*, where it had been injured and is undergoing reparation; the chitinous tubes, with their cœnosarc contents, are seen extending themselves in the form of a network, the meshes of which subsequently become obliterated by the coalescence of the chitinous walls.

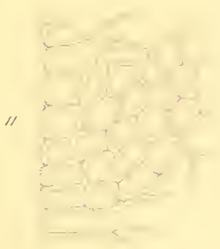


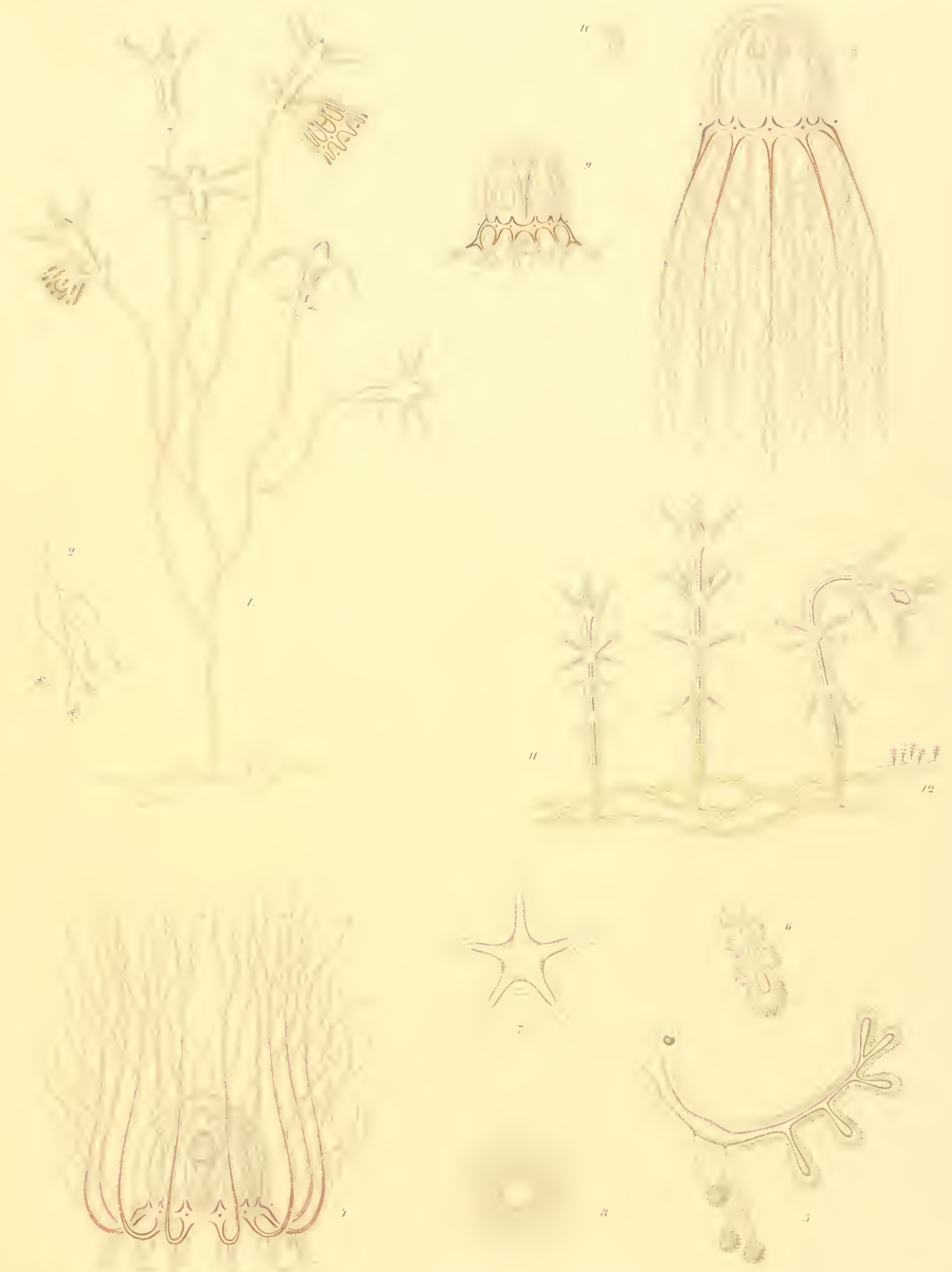


PLATE XVII.

CLADONEMA RADIATUM, STAURIDIUM PRODUCTUM.

FIG.

1. A colony of *Cladonema radiatum*, magnified. The drawing has been made from the free variety of this hydroid. (See the description of the species, page 358.)
2. The same, slightly larger than natural size.
3. *Cladonema radiatum*, a free mature planoblast floating in the water.
4. The same fixed by its appendages of attachment, and with its marginal tentacles thrown back over its umbrella.
5. A marginal tentacle contracted; the three appendages terminating in spherical capitula near the base of the tentacle are the appendages of attachment, and do not participate in the contraction undergone by the rest of the tentacle and its branches. The ocellus, with its pigment and refracting body, is seen in the enlarged base of the tentacle.
6. Extremity of one of the nodulated branches of a marginal tentacle slightly contracted.
7. Origin of the radiating canals as seen from the summit of the umbrella.
8. Velum showing its great width and its circular and radiating fibrillæ.
9. Planoblast at the period of its liberation.
10. Mature planoblast, natural size.
11. *Stauridium productum*, a colony magnified.
12. The same, natural size.



1-10 *Cladenema radiatum* 11, 12 *Stauridium productulum*.



PLATE XVIII.

CLAVATELLA PROLIFERA.

FIG.

1. A colony, magnified.
2. The same, natural size.
3. One of the tentacles of the hydranth much magnified.
4. The free ambulatory medusa (planoblast) as seen when it has attached itself by its suctorial discs.
5. The planoblast viewed from the vertex, showing the radiating and circular canals. *a*, a young medusa-bud; *b*, a medusa-bud more advanced.
6. The ocellus showing its pigment and refracting body.
7. Extremity of a marginal tentacle of the planoblast showing its two branches, one of which is provided with a suctorial disc of attachment.
8. Vertical section of planoblast showing ova carried in its summit between ectoderm and endoderm; *a*, mouth; *b*, *b*, marginal tentacles.
9. Young medusa-bud developed from the base of the hydranth.
10. Medusa-bud more advanced, marginal tentacles still simple.





PLATE XIX.

CORYMORPHA NUTANS.

FIG.

1. The entire hydrosoma, magnified; *a*, papilliform processes from the stem; *b*, *b*, filamentary appendages emitted from the proximal end.
2. A group, natural size, as it appears when confined in an aquarium, the proximal ends plunged into the sandy bottom. This may fairly be taken as representing the mode of existence of *Corymorpha nutans* in its natural habitat at the bottom of the sea. Some planoblasts just liberated are seen swimming about.
3. One of the branched peduncles from the gonosome carrying gonophores in various stages of development, more magnified than fig. 1.
4. A planoblast shortly after liberation; its tentacle contracted. Much magnified.
5. Mature male planoblast, magnified.
- 5*a*. The same, natural size.
6. Transverse section of the stem about the middle of its length; *a*, delicate external pellicle; *b*, ectoderm; *c*, fibrillated layer, *d*, peripheral portion of endoderm composed of small spherical cells with coloured granular contents, and excavated by longitudinal canals; *e*, axial portion of endoderm composed of large polygonal cells with clear homogeneous contents.
7. Longitudinal section of hydranth; *a*, distal portion of hydranth cavity; *b*, proximal portion communicating with *a* by a narrow axial channel, and receiving the longitudinal canals, *c*, of the stem; *d*, ectoderm; *e*, outer clear-celled portion of endoderm; *f*, inner portion of endoderm lining the hydranth cavity, and composed of cells with coloured granular contents; *g*, base of proximal set of tentacles; *h*, base of distal set; *i*, peduncles of the gonophores.
8. Portion of a proximal tentacle of the hydranth seen in longitudinal section.
9. Portion of a distal tentacle of the hydranth seen in longitudinal section.
10. One of the papilliform processes of the stem extended.
11. Same, contracted.
12. Free frustule of *Corymorpha nutans* contained within its delicate chitinous tube which adheres to the sides of the jar.
13. The same body after it has become fixed by one end and developed a hydranth from the other.
14. The same, more advanced.



Cerymerpha nulaus

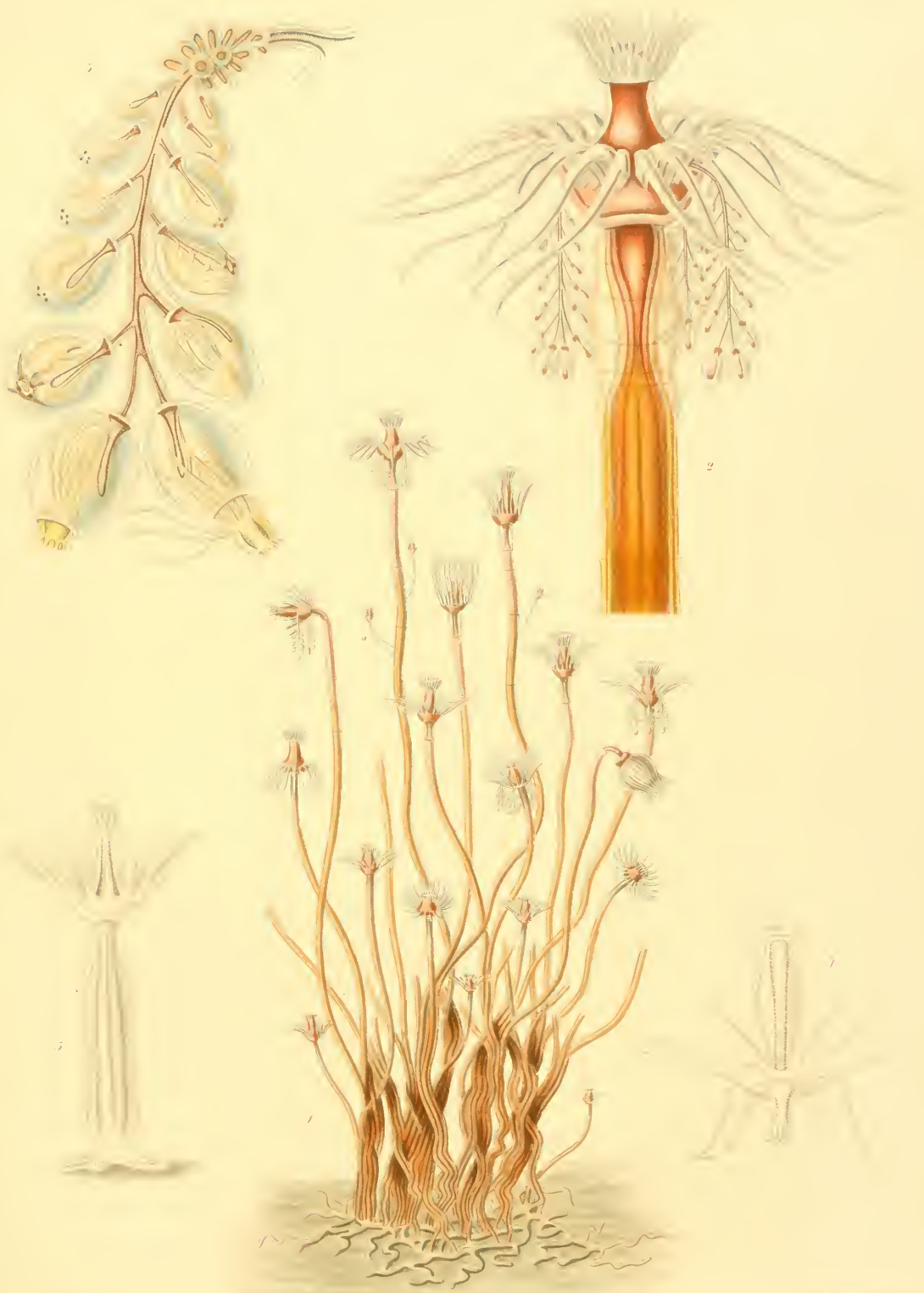


PLATE XX.

TUBULARIA INDIVISA.

FIG.

1. A male colony of *Tubularia indivisa*, natural size; *a*, young individuals which had attached themselves to the stems of the adult colony.
2. A hydranth from a male colony, with its pendulous raceme-like clusters of gonophores, magnified.
3. One of the raceme-like clusters of gonophores from a female colony. The sporosacs, with their contents, are seen in various stages of development. Close to the root of the common peduncle the very young sporosac-buds may be seen in the form of densely aggregated, sac-like diverticula from the tube of the peduncle. As these approach the distal end of the peduncle they are seen to become more and more developed; the generative plasma surrounding the spadix has become distinct, then this is seen to have thrown off masses which become developed into actinulae; the actinulae gradually assume their complete form, and at the extreme end of the raceme they are seen fully developed, escaping through an orifice in the summit of the sporosac.
4. An actinula shortly after liberation. It is figured in the attitude assumed when moving from place to place; the mouth is turned towards the surface, over which the actinula is moving, while some of the long tentacles are bent in the same direction, and are employed as ambulatory organs.
5. The actinula after it has permanently fixed itself. It has developed a stem, thrown out hydrorhizal processes of attachment, and excreted a periderm. The endoderm of the stem has already become canaliculated as indicated by distinct longitudinal striæ.



Pabokeria undivisa



PLATE XXI.

TUBULARIA LARYNX.

FIGS.

1. A hydranth from a male colony, with its long simple racemes of gonophores; magnified.
2. A hydranth from a female colony, with its shorter compound racemes of gonophores; magnified.
3. An entire colony, natural size.
4. A portion of the hydroecaulus, showing the interrupted annulation of the perisarc; slightly magnified.
5. Summit of stem much magnified, showing the fluted collar-like expansion, *a*, of the ectoderm. The perisarc is continued from a point at a little distance below the collar as a thin filmy and transparent tube over the distal portion of the stem.
6. An actinula some days after its liberation, as it is seen floating in the surrounding water; magnified. The oral tentacles, which are absent at the period of liberation, have already become developed.
7. The actinula after it has permanently fixed itself. It has developed a stem which is clothed with a chitinous perisarc, and has emitted hydrorhizal processes of attachment. The young stem is excavated into a single cavity instead of being traversed by several longitudinal canals, as in the corresponding stage of *Tabularia indivisa*. Very distinct currents are visible through the transparent walls of the stem, as indicated by the arrows in the figure.



Tubularia larva



PLATE XXII.

TUBULARIA ATTENUATA, TUBULARIA HUMILIS, TUBULARIA BELLIS.

FIGS.

1. *Tabularia attenuata*, a hydranth from a male colony, with its short erect clusters of gonophores ; magnified.
2. A colony of *Tabularia attenuata*, natural size.
3. *Tabularia humilis*, a hydranth from a male colony, with its short erect clusters of gonophores ; magnified.
4. A colony of *Tabularia humilis*, natural size.
5. *Tabularia Bellis*, a hydranth from a female colony, with its erect clusters of gonophores, in some of which the actinulæ may be seen already developed ; magnified.
6. A colony of *Tabularia Bellis*, natural size.

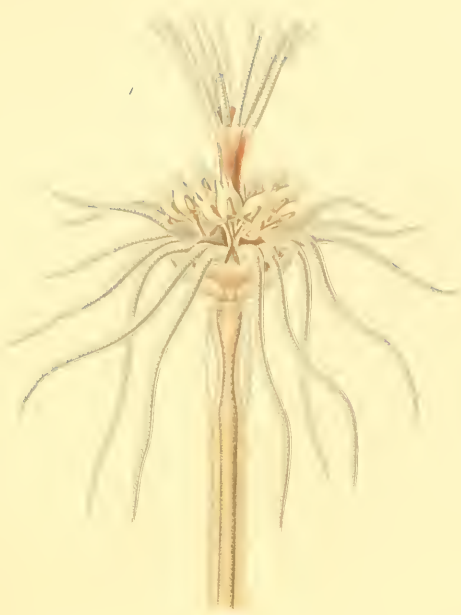




PLATE XXIII.

TUBULARIA INDIVISA AND TUBULARIA LARYNX. ANATOMY AND DEVELOPMENT.

FIG.

1. *Tubularia indivisa*, vertical section through the body of the hydranth; *a*, endoderm lining the distal portion of the hydranth cavity; *b*, endoderm lining the proximal portion; *c*, pendulous lobes of endoderm separating the distal from the proximal portion of the hydranth-cavity. (See page 124.)
2. Pendulous endodermal lobes in hydranth-cavity of *Tubularia indivisa*; profile view.
3. A single lobe more magnified.
4. *Tubularia indivisa*, one of the tentacles of the distal circle, focalised in a longitudinal plane passing through the axis, and showing the ectoderm, endoderm, and intervening fibrillated layer. (See page 206.)
5. *Tubularia indivisa*; portion of one of the proximal zone of tentacles, showing the fibrillae of the muscular layer. In the ectoderm some thread cells are seen with the filament exerted.
6. Some of the fibrillae of the muscular layer isolated and magnified about 200 diameters. (See p. 206.)
7. *Tubularia indivisa*, transverse section of the stem; *a*, perisarc showing numerous successive layers of thickening; *b*, ectoderm; *c*, peripheral layer of endoderm composed of small spherical cells with coloured granular contents, and excavated by the longitudinal ciliated canals; *d*, central portion of the ectoderm composed of large cells with clear, colourless contents, and forming a solid, pith-like axis. (See p. 206.)
8. *Tubularia indivisa*, male gonophore; *a*, ectotheca; *b*, mesotheca; *c*, radiating canal; *d*, circular canal; *e*, endotheca; *f*, spermiatic mass; immediately over the circular canal is seen the apical orifice of the gonophore. (See page 207.)
9. Free spermatozoa of *Tubularia indivisa*.
10. *Tubularia indivisa*, transverse section through spadix, showing its ciliated cavity and its proper tissue surrounded by the spermiatic plasma. (See page 207.)
- 11—16. Development of actinula in *Tubularia indivisa*. (See page 90.)
11. Female gonophore; *a*, ectotheca; *b*, mesotheca; *c*, radiating canal; *d*, apical orifice surrounded by circular canal; *f*, generative plasma enveloping the spadix; *g*, mass detached from generative plasma, and about to become developed into an actinula. The endotheca has already disappeared.
12. Cells composing the mass detached from the generative plasma (*g* in fig. 11).
13. The actinula in a very early stage. It is in the form of a concavo-convex disc, which embraces the spadix and residual plasma. Its interior is hollowed out into a cavity.
14. An ectoderm and endoderm has become differentiated, and the margin presents a shallow lobing, the commencement of tentacles.
15. The tentacles have become distinct, having increased in length, and the embryo now presents the form of a star.
16. The actinula is fully formed and ready to escape from the gonophore; a circle of short tentacles, *a*, has become developed round the mouth.
17. Thread-cells from the hydranth of *Tubularia indivisa*; *a*, ordinary form of thread-cell before evolution; *b*, the same after evolution; *c*, minute bean-shaped thread-cells.
18. Cells from the lining of the hydranth cavity in *Tubularia larynx*. Some of these cells contain within them clear secondary cells; in others the secondary cells contain a brood of still younger cells, or are filled with a coloured granular matter. Some of the secondary cells with their granular contents are seen in the figure to have been liberated by the rupture of the mother-cells. (See page 134.)
- 19—24. Development of actinula in *Tubularia larynx*. (See page 91.)
19. Very young female gonophore; *a*, ectotheca; *b*, endotheca; *f*, generative plasma.
20. Cells composing the generative plasma in fig. 19 treated with acetic acid, and magnified about 250 diameters.
21. Gonophore at a more advanced stage than fig. 19; *a*, ectotheca; *d*, commencement of apical processes; *b*, endotheca; *f*, generative plasma.
22. Cells composing the generative plasma in fig. 21 treated with acetic acid.
23. Gonophore still more advanced; the apical processes have become larger, the endotheca has disappeared, and the generative plasma has thrown off a mass which is about to become developed into an actinula; *f*, residual plasma enveloping the spadix; *g*, mass which had been detached from the plasma.
24. Gonophore containing a fully developed actinula in the act of liberation; *f*, residual plasma enveloping the spadix; *g*, a mass which had been detached from the plasma, lying free in the cavity of the gonophore; *h*, *h*, completely formed actinula escaping through the orifice between the apical processes of the gonophore.



Anatomy and Development of Tubularia

1-17 Tubularia indivisa 18-24 Tubularia lucida



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